# CANADIAN ARCHITECT AND BUILDER.

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CANADIAN ARCHITECT AND BUILDER,

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(With a Weekly Intermediate Edition—The CANADIAN CONTRACT RECORD),

PUBLISHED ON THE THIRD SATURDAY IN EACH MONTH IN THE INTEREST OF

ARCHITECTS, CIVIL AND SANITARY ENGINEERS, PLUMBERS, DECORATORS, BUILDERS, CONTRACTORS, AND MANUFACTURERS OF AND DEALERS IN BUILDING MATERIALS AND APPLIANCES.

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***EDITOR'S ANNOUNCEMENTS.***

Contributions of technical value to the persons in whose interests this journal is published, are cordially invited. Subscribers are also requested to forward newspaper clippings or written items of interest from their respective localities.

***The "Canadian Architect and Builder" is the official paper of the Architectural Associations of Ontario and Quebec.***

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SEVERAL of the largest manufacturers of lime in Toronto, Milton and Guelph have consolidated their interests, and will hereafter be known as the Ontario Lime Association. Toronto will be the headquarters of the Association. An effort will no doubt be made to stiffen prices.

THE Association of Provincial Land Surveyors of Ontario are applying to the Legislature for incorporation. For some reason or other the Bill which has been introduced with this object has met with considerable opposition. The influence of this opposition seems likely to also stand in the way of the required amendments to the Ontario Architects' Act.

A CORRESPONDENT writes: "Allow me to congratulate you on the editorial article on cement testing in February issue of CANADIAN ARCHITECT AND BUILDER. I for one would be very glad to see your ideas regarding the establishing of a Government laboratory for testing cements carried out. Should occasion require it, you are at liberty to use my name as having been one of the sufferers. I can fully corroborate the statements contained in your article."

COL. Tracy, City Engineer of Vancouver, B. C., advises us that it is the purpose of the council of that city during the approaching summer to commence the use of bituminous rock pavement. This material, which will be imported from Southern California, is described as being a good deal like asphalt, with the exception of being elastic, giving a good foothold to horses. Our informant regards it as being almost an ideal pavement. The success of this material will be watched with interest by other cities.

A CORRESPONDENT writes from British Columbia concerning Christ Church Cathedral competition, Victoria, B.C., as follows: "All designs received at this end are being forwarded unopened to the Church House, Westminster, Eng., where those prepared by English architects will be received. They will then be examined by Canon Beaulands and Mr. B. Ferry, architect, and the ten most suitable designs will be submitted to Sir A. W. Blomfield, whose decision as to the merit and award of prizes will be accepted by the plans committee. Some local architects have competed, but we believe many others have held aloof, not altogether liking the conditions of competition."

BUILDING operations in Montreal promise to be somewhat extensive during the approaching summer. Strong efforts have been made for a year past by certain real estate speculators to boom suburban properties, and in spite of the experience of Toronto, the older and more conservative city has shown itself to be susceptible to the boomster's art. It is unlikely, however, that speculation in land or building will be carried to anything like the pitch attained in Toronto during the recent period of inflation. While anything bearing the least resemblance to wild-cat speculation ought to be severely discouraged, every possible encouragement should be afforded to legitimate building enterprises.

THE Ontario Association of Architects will hold the first examinations under the Act of Incorporation at the School of Practical Science, Toronto, on the 5th, 6th, 7th and 8th of next month. Three examinations will be held at the same time, the first and second intermediates and the final, and there are some sixty candidates coming forward to undergo the tests of their proficiency in the various stages. The Board of Examiners consists of seven members: Prof. Galbraith, chairman, and Messrs. C. H. C. Wright, E. Burke, R. W. Gambier-Bousfield, S. G. Curry, F. Darling and S. H. Townsend. This is the first of a long series of examinations, let us hope the result of which will be that the danger the public are now in, of falling into the hands of unskilled practitioners, will in time be done away with. Now a youth must perforce go through a regular course of training, passing examinations at certain stages to test his progress and show him in what particulars he is weak, until having passed the final examination, he may practise his profession with honor to himself and for the good of the public.

THE architectural students of Ontario are at present on the anxious seat in view of the approaching April examinations. Many architects now in practice regret that such examinations were not required of them during their studentship. Students of the present day should, therefore, appreciate the facilities which, under the Ontario Architects' Act, have been placed at their disposal for acquiring a proper knowledge of architecture. With the object of assisting students who shall present themselves as candidates for examination, we publish a paper on "Heating and Ventilation," by the President of the O.A.A., Mr. S. G. Curry, and also a paper on "Elements of Building Construction" and "Structural Iron Work," by Mr. E. Burke, recently read before the members of the Toronto Architectural Sketch Club. The authors have been appointed examiners in the subjects treated of in their respective papers.

IT is every day becoming more apparent that the activity which was expected to mark the coming season in Toronto in consequence of the changing of the street railway system and the construction of permanent pavements on the leading streets, will not be witnessed. The Council are in a fair way to spend the balance of the year in discussing the merits of the trolley versus the storage battery system of street car propulsion, notwithstanding that their experts reported in favor of the trolley, and in the face of the fact that the experimenting which has been done by American cities points to the trolley system as being at present the only one which can be depended on to do the work satisfactorily, especially where heavy grades and heavily laden cars are among the difficulties to be encountered. It is right enough that the Council should endeavor to make provision for the adoption of a system more perfect than the trolley, should such be made available before the period of the present company's franchise shall have expired, but they are not justified in throwing over the carrying out of this great improvement for another year when the evidence all tends to show that no corresponding advantage is likely to be gained. The outlook for the building trades is none too encouraging. There is consequently the greater reason why the City should endeavor to afford employment on as extended a scale as possible to artisans and laborers.

THIS is not the first time that we have taken occasion to speak of the Mechanics' Lien Law and its many disadvantages. The act remains in force, and as long as this is the case there will be heard from all sides complaints of its cumbersomeness, expense in procedure, and its incomprehensiveness. We have more than once heard it said by "persons in authority" when asked to explain some part of the Lien Law, "It's not surprising you don't understand it, for nobody ever did." This assertion is, of course, an exaggeration, but it has a great deal of truth in it. Surely then it is time to amend a law that has such obvious flaws in it. Many people, and among them lawyers of eminence, contend that it would be better to abolish it at once. The fact is, the system on which the law is based is wrong. It encourages fraud, as it attempts to legislate for credit, giving considerable opportunity for dishonesty. It fosters speculative building, and dishonest builders have not failed to take advantage of it, causing an amount of distress, annoyance and embarassment that it would fill volumes to dilate upon. Were there no Lien Law, there would not be much credit. But under the existing state of things the material man prefers to sell his goods on credit and run the chances of being able to protect himself by a lien, to not selling anything, the man who gives credit being the one who secures the orders. The material man can come down on the innocent owner, and so can the workman, and force him to pay again that which he has already paid the builder who has absconded, for the percentage retained in making advances to the builder rarely are sufficient to cover the whole costs. The system of credit is bad, but this plan of safeguarding the man who gives credit in order to sell his material is worse.

MUCH has been heard of the danger attendant upon the system of stringing electric wires overhead, and reiterated demands have been made that all wires be placed underground. It is questionable, however, whether the carrying out of this demand would not tend to enhance rather than diminish the danger. An example of the peril which is likely to attend the underground system occurred in Toronto a few days ago. Illuminating gas from the street mains found its way in sufficient quantity into one of the man-holes in the public streets through which passes a telephone cable, to require but the faintest induction spark from the covering of the cable, or a spark of atmospheric electricity to cause an explosion. The spark appears to have been forthcoming, for suddenly the heavy iron man-hole covering which had been firmly bolted down, was torn from its seat and carried into the air. A horse which was being driven past the spot at the moment fell into the man-hole, and before it could be extricated there occurred a second explosion, burning the animal severely. The driver of the horse and another person who happened to be near the man-hole when the explosion occurred escaped with slight injuries. It is a well-known fact that about 10 per cent. of the total supply of illuminating gas which goes into the street mains leaks out at the joints and saturates the earth. This gas must find its way into the man-holes, and when the right admixture of gas and air is reached, the material is ready for an explosion. There is always danger with underground wires that the inductive current set up in the lead covering of the cable may become sufficiently strong to generate a spark which would be the means of igniting the combustible materials. Had the explosion to which we have referred taken place in the man-hole at the intersection of King and Yonge streets, where the traffic is always great during business hours, there would in all probability have been many persons killed. The daily press which has so often held up to view the horrors of the overhead system, should now have something to say on the other side of the question.

A VERY singular case has been before the courts for some time, and it will be probably many months before we hear the end of it. As it contains points of considerable interest, we give the story as far as it has gone at present. Three prominent men of Waterford, Ontario, built a block of business premises on the main street of that town. The boundaries of the street had not been definitely decided, but when they were, it was found that the new block encroached some six feet upon the street. The owners of the building were proceeded against for allowing a nuisance and were fined. They appealed, but the result was an order to remove the "nuisance" within three months. This they failed to do, and the County judge allowed a writ of *de nocumento amovendo* to issue, which enjoined the sheriff to pull down the projecting part of the block at the owners' cost. The barrister in charge of the owners' interests held that the County judge had not the power to issue this curious writ, but that it was a matter for the High Court. He succeeded in obtaining a writ of *certiorari* during the recent term, so that proceedings were stayed on account of the irregularity, and will proceed during the ensuing term to apply for a rule *nisi* whereby the present proceedings will be quashed. The case gains interest from the fact that the writ of *de nocumento amovendo* is said to be the first that has been issued for a hundred years. The matter may still be brought before the High Court, and if so, the owners are liable to a fine of almost any amount, and repeated fines until the "nuisance" complained of is removed. There seems to be a difference as to the term which may be applied to an encroachment upon adjoining property, for there is a case recorded in which, by a mistake, a house was erected with one side wall, just its thickness, nine inches, on the adjoining lot. In this case the owner was proceeded against, not for a "nuisance," but simply for encroachment, and when the sheriff was ordered to tear down the wall he found he could not do so without injury to that part of the house touching the wall on the other side, and clearly within the lot of the house owner. He had no right to enter upon the lot or touch anything therein, and so far as we have been able to discover, the matter had to be left in this state.

## OUR ILLUSTRATIONS.

HOUSE FOR A. R. REID, ESQ., MONTREAL.—ALEX. C. HUTCHISON, ARCHITECT.

This building was erected in Upper Drummond street some eighteen months ago. The fronts are of red Scotch and red New Brunswick sand stone. It is at present without the library shown on the plan, but it is proposed to make this addition during this year.

CHURCH OF THE MESSIAH, AVENUE ROAD, TORONTO.—GORDON & HELLIWELL, ARCHITECTS, TORONTO.

SKETCH OF SUMMER RESIDENCE ON TORONTO ISLAND.—LANGLEY & BURKE, ARCHITECTS, TORONTO.

INTERIOR OF HALL, F. D. MONK'S RESIDENCE, MONTREAL.—J. W. & E. C. HOPKINS, ARCHITECTS, MONTREAL.

## OBITUARY.

It becomes our painful duty to chronicle the death of Mr. John Webb, one of the oldest, most prominent, and most highly esteemed contractors of the City of Hamilton. Death was the result of a severe attack of rheumatism, culminating in severe spasms of the heart after an illness of seven weeks. The subject of this notice was born near Hythe, in Kent County, England. He came to this country in 1871, and immediately entered into business in Hamilton as a contractor and builder. Among the buildings erected by him may be mentioned the *Times* building, Ryerson school, West Avenue school, Canada screw works, James McPherson & Co's building, the buildings occupied by Messrs. F. W. Fearman & Son, Thos. Lawry & Son, W. H. Gillard & Co., St. John's Church, the Tuckett tobacco factory, and others which were both a credit to him and to the city. He leaves a widow and nine children, four sons and five daughters. Deceased was a member of Doric Lodge, A. F. & A. M., and a charter member of Gore Lodge, A. O. U. W. For a number of years he was an active member of the Charitable Committee of St. George's Society. He was noted for his uprightness of character and kindliness of disposition.

## PUBLICATIONS.

Messrs. H. R. Ives & Co., have issued an attractively printed little book, embellished with a number of humorous illustrations, calling attention to the advantages of their Buffalo hot water boiler, corrugated soil pipe, etc.

Elizabeth Bisland opens the March number of the *Cosmopolitan* with an article on the Cologne Cathedral, beautifully illustrated from photographs. M. H. de Young, Commissioner of the World Fair from California, has a most interesting article on expositions. The illustrations accompanying this article are from the pen of Harry Fenn and adequately display to the readers the architectural glories of the Fair buildings.

## CANADIAN CITY ENGINEERS.

V.

HURD Peters, City Engineer of Saint John, New Brunswick, was born at Fredericton, N. B., being one of the younger sons of Hon. Charles Jeffrey Peters, Attorney-General of that Province.

After passing through the Collegiate school (silver medal) Mr. Peters took his degree of A.B. and A.M. at King's College, from the University of N.B. (gold medal). He also took his diploma at the special course in engineering at that time instituted under Mr. Cregan, C.E.

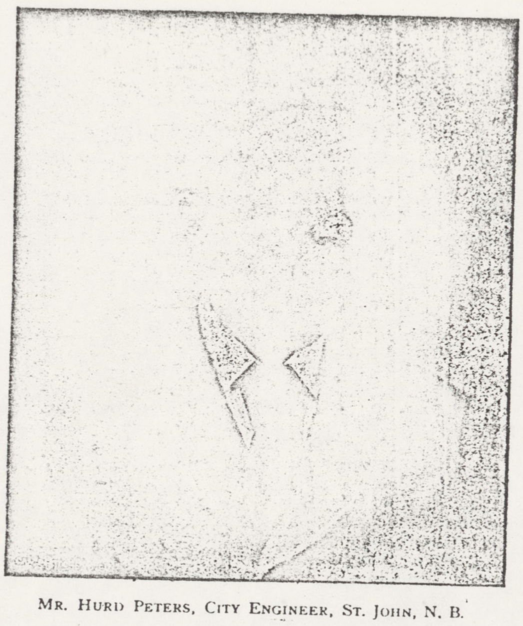
After having been employed on the European and North American R. R. between St. John and Vanceboro' and on what is now the Intercolonial, between St. John and Moncton, as leveller, he spent some time working in the United States.

In 1854, in partnership with I. Edward Boyd, M.I.C.E., who recently died while in charge of the harbor works, Quebec, he opened an office under the title of Peters & Boyd for private practice in St. John. When Mr. Boyd subsequently took a position on the government railways, Mr. Peters continued in private practice until April, 1861, when he was appointed City Surveyor. Two years later, July, 1863, he was appointed City Engineer—that office being then for the first time established—and has so continued to the present time. He was one of the first Council of the Canadian Society of Civil Engineers, and his name appears in the Act of Incorporation.

The record of Mr. Peters' work is to be found in the present state of the city, for which he has been engineer for some 30 years.

Mr. Peters has also taken an active part in militia affairs, having retired with the rank of Lieut.-Col. 2nd Battalion St. John County Militia. He has likewise filled positions of trust in connection with the Episcopal Church.

Mr. Peters had his residence and office with all his plans and memoranda, destroyed in the conflagration which overtook St. John in 1877.



MR. HURD PETERS, CITY ENGINEER, ST. JOHN, N. B.

## QUERIES AND ANSWERS.

"J. B. R." writes as follows from the Northwest Territory: "It was the intention of the company with which I am employed as superintendent of construction to build concrete, but for different reasons the company changed to frame and rough-cast. This left a large quantity of Selkirk lime on hand. Last fall I dug a large pit 14' x 12' x 2', and ran it full. After covering it with a good layer of sifted sand, I placed a rough floor over this, then another layer of sand and protected this again with manure. Will I meet with as good results when I require it as if I had left it to air slake? I was never placed in this position before, but was once told by a stone mason that the longer the lime lay in this state the better."

[ANS.—Storing lime in the manner mentioned by our correspondent is calculated to improve rather than to injure the quality. In England lime is frequently stored in cellars for the purpose of improving it. When thus treated it is called "putty lime," and is chiefly used for finishing. Unless the lime has suffered from the severe frosts, it will no doubt be found all right, and we would advise our correspondent if possible to keep it for finishing purposes. It will be found to be cool and will not crack.—ED. C. A. & B.]

## PROVINCIAL LAND SURVEYORS.

THE seventh annual meeting of the Association of Provincial Land Surveyor of Ontario, was held in the Canadian Institute, Toronto, on Fed. 23rd, 24th and 25th. In addition to the transaction of much important business, papers were read as follows: "Cement and Cement Mortars," Mr. J. Butler, P.L.S., C. E., Napanee, Ont; "Does the Passing of an Act of Parliament Alway do Justice?" A. Niven, P.L.S., Haliburton; "Hints to a Surveyor About to Survey a Township for the Ontario Government," W. R. Burke, P.L.S., Ingersoll, Ont.; "Compass Lines," John McAree, D.T.S., Toronto; "The Value of Old Records in Relation to Municipal Surveys," Geo. B. Kirkpatrick, P.L.S., Crown Lands Dept., Toronto; "Sewerage for Towns and Villages," H. J. Bowman, P.L.S., C.E., Berlin, Ont.; "Georgetown Water Works," James Warren, P.L.S., C.E., Kincardine, Ont.; "Hamilton and Barton Incline Railway," J. W. Tyrrell, P.L.S., C.E., Hamilton, Ont.; "Storage of Water on the Trent System," R. B. Rogers, P.L.S., C.E., Peterboro', Ont.; "Exploring for Nickel," C. E. Fitton, P.L.S., Orillia; "Railway Surveys," H. K. Wicksteed. P.L.S., C.E., Cobourg, Ont.; "Rock Blasting of Trenches for Water Works and Sewerage Purposes," A. L. McCulloch, P.L.S., C.E., Galt, Ont.

On the evening of the 24th inst., a pleasant time was spent by the members at the annual dinner of the Association, which took place at the Arlington.

## AMATEUR DECORATING.

BY W. H. ELLIOTT.

I NOTICED a paragraph a short time since in a daily newspaper in which the writer bewailed the slavery into which suffering humanity had fallen to the autocratic decorator. "People," said he, "no longer embody in their rooms their own taste, and are denied the opportunity for displaying to admiring friends their admirable traits of character; on the contrary, a woman of simple tastes is put into a georgeous boudoir of extreme French design and so on." The perpetual hunting for a grievance in writing on æsthetic matters is at times very wearisome, especially in view of the fact that in most cases the fault-finding with existing conditions is not borne out by actual experience. The cry for something different continually goes up, though Heaven only knows what different is wanted. If French ideas are introduced the good old English simplicity has gone for ever. If solid English design is used the æsthetic grumbler sighs for the lightness and greater artistic beauty of the French. And now we are told that the helpless public has fallen hopelessly into the hands of the professional decorator, and what an unfortunate thing it is that one cannot choose one's surroundings for one's self, as if we do not all know that for a decade past the decorating amateur has revelled in a reign of terra cotta and muddy green to his heart's content, producing the most thrilling effects for those who responsively thrill. And it is only that we have emerged at last from this period of indefiniteness and taken up something requiring knowledge, skill and caution in its handling—I say it is only for this reason that our æsthetic Israelites are lamenting their captivity and the end of their muddy period. Now it is not true that the decorator usually serves all people alike without regard to their characters, tastes and positions. In a great many cases he has a clearer idea of what will suit his client than the client can possibly have because of his inexperience and lack of knowledge of many possible variations in the treatment of his rooms. In how many cases does the ambitious householder see an effect in somebody else's house or at an hotel or in a pullman car which if not modified or tabooed entirely by the decorator, would be appropriated for the house and lay the householder open to the ridicule of every one of good taste. We feel a tender pity for the man who commits himself to the "every man his own architect" sort of influence, but the results consequent upon every man becoming his own decorator are quite as sorry and frequently more palpable because of the lack of examples to follow, such as every builder of houses has in the houses already built.

The refined and classical styles at present in vogue calling for decorative taste of the highest order, cannot be successfully played with by ambitious amateurs, and yet may be safely used in some one or other of their variations to suit almost anybody's taste and pocket book. What more can we ask than that, after providing a suitable background, he leave to our individual tastes the many little accessories, that more than the walls and ceiling may be made to exhibit an individuality and preference. Prettier rooms by far will be made for the next few years than have been made in the preceding ones, and the effect will rarely be marred for the lack of interference on the part of the amateur decorator.

Messrs. Evans, Coleman & Evans have been appointed agents at Vancouver for the British Columbia Terra Cotta Co., of Victoria, B. C. The company have produced some fine samples.

A patent Spanish tile made of copper and tin is being manufactured by Merchant & Co., of Philadelphia. Among the advantages claimed for them is that they are much lighter and more durable than tiles made from clay.

The Manitoba Stone and Asphalt Paving Co. have started business in Winnipeg. It is their intention to engage in the manufacture of tiles, to construct asphalt pavements, and act as agents for American manufacturers of pressed brick, over-mantels, etc.

## "ELEMENTS OF BUILDING CONSTRUCTION—STRUCTURAL IRON WORK."

THE following lecture to first and second intermediate students on the "Elements of Building Construction," and to second intermediate students on "Structural Iron Work," was delivered at the Toronto Architectural Sketch Club by Mr. E. Burke, examiner in the above subjects:—

In presenting a paper on the elements of building construction before the first year students, the brief time at my disposal will permit of but a rapid and cursory presentation of the subject. In fact, the most of your work is so admirably covered in Mitchell's "Elements of Building Construction" that I will avoid a repetition of the points there covered, and endeavor to touch some not mentioned—especially where Canadian methods differ from those in vogue in England.

Prof. Aitchison in one of his recent lectures said: "Building consists in putting the materials we have at command in certain positions, and giving them certain forms. The size and shape of these forms depend on certain statical considerations. Arithmetic, mathematics and geometery can alone enable us to solve the necessary statical problems; so these elements must first be mastered to enable us to solve the statical problems that present themselves. Next comes the knowledge of the strengths and capabilities of the materials we have to use." Fortunately we now live in times when these strengths and capabilities are being determined with more accuracy than in the past, although we have to admit that most of our data is so indefinite that we are compelled when we build to employ what is called a "factor of safety," which in reality is a "factor of ignorance." For instance, a beam of a certain scantling is supposed to break under a strain of a certain number of pounds. As a matter of fact it may break at half that amount, as was demonstrated at the School of Science during our late convention. Hence it is usual in our constructions to allow from 5 to 10 times the supposed breaking strength of a material for a so called "factor of safety."

The first point in commencing a building is the question of the nature of the soil or bed upon which the walls are to rest. If this be of rock or of some compact dry substance which is comparatively unyielding, it is called a *natural* foundation and may be built upon directly. But if the ground is too soft to bear the weight of the structure required, it will need an artificial foundation. This may be obtained in a variety of ways: *First*, by planks in two or more thicknesses laid reversely and of sufficient breadth to sustain the weight above without undue settlement; *second*, by a bed of concrete of sufficient depth and width; *third*, by piles driven to a solid bottom, cut off evenly at tops to receive plank, concrete or stone footings; and *fourth*, by a gridiron of steel rails as developed by the necessities of Chicago building operations, where great spread is required in proportion to the height available for the footing courses. Where planks or piles are used, it is imperative that they be constantly submerged in water to prevent decay and the eventual collapse of the foundation of the structure. Footings should not project more than two-thirds of their thickness beyond the work above, and at least two-thirds of their width should be covered by the work above. Good rubble walling should be composed of stones thin in proportion to their length and breadth. The centre of gravity should be observed in placing the walls upon the footings and base of the building, allowance being also made for the weight of floors and partitions. In placing columns carrying weight it is of the utmost importance that they should be centrally placed. The non-observance of this rule was one of the causes of the accident to the Montreal Y.M.C.A.

The various bonds of brickwork used in England are clearly explained in "Mitchell." American bond, called "Stretching" or "Chimney Bond," is only recommended for ½ brick walls; while it makes a weak wall it certainly produces a much better appearance in a 9" wall than any other method of laying. A wall of this thickness having headers cannot be built smooth and even on both sides, as all bricks vary more or less in length. The diagonal bonders every 5th course give a wall built with this bond as much stiffness as is necessary for a wall of the limited height to which one this thickness should be carried. This bond also lends itself to the construction of hollow walls where one shell is but a half brick thick and can be bonded into the rest of the wall with hoop iron ties which should have a dip to prevent the water of condensation being carried to the inner thickness of the wall.

Mitchell speaks of built up wooden beams, that is, beams made up of several thicknesses of stuff, in connection with temporary structures chiefly, and that they are economical. In our practice this method of construction is considered superior to solid beams. Among others are the following reasons:—The material being of thin stuff, defects can be more readily detected and a superior quality secured. With several thicknesses the change or reversal of the grain thus obtained helps the stiffness of the construction, and by a system of splicing or breaking joint, no two joints coming opposite, long spans may be covered, such as the tie beams of roof principals. And lastly, the wood may be obtained better seasoned.

Much of the splicing, cogging, jointing and morticing dealt with in Mitchell is practically obsolete in this country, much better results being obtainable by the use of wro't iron bolts, straps and stirrups, the use of which avoids the inevitable weakening of parts which should be the strongest. The high rate of wages is also prohibitive, as the making of the joints illustrated would consume an immense amount of time, which in these days is, indeed, money. At the same time a great deal of the common class of work of to-day is to be deprecated,—there is too much tendency to "knock things together," superinduced by the craze for cheapness and inordinate haste, after the example set by our restless cousins to the South who use the almighty nail and trust it implicitly. With us deep joists are so readily obtainable that we do not need, as a rule, to resort to the English method of beams at comparatively short spacing and light joists with a counter ceiling to conceal the beams: a method wasteful as to height and creating in the large hollow spaces a very paradise for vermin. The practice of bevelling the ends of joists to prevent injury to the walls in case of fire is not mentioned, but is a very necessary precaution, perhaps more in regard to the prevention of loss of life and spread of fire than in the mere saving of the walls themselves. None of the methods of jointing flooring equal ours for adaptability, simplicity and ease of laying. Much of the ordinary work in England is without jointing, permitting dirt and moisture to drop to the ceiling or floor below.

In regard to roofs, the student must be warned against the examples in "Mitchell" where gutters are formed behind parapet walls. The only successful roof in our climate is that which permits the snow and ice to have free escape to the ground. To this end valleys should have ample space at the foot, enlarging as they approach the eaves, and gutters should invariably be set low enough to permit snow to slide off without obstruction. A bell-cast at the foot of the rafter will accomplish the same object. Facias should also project sufficiently to have a drip clear of the walls beneath.

Slates or tiles must, with us, be laid upon a solid substance. The English method of setting upon battens would permit our fine dry snow to blow in, and the extreme cold outside and the heat inside would cause condensation on the under-side resulting in wet ceilings. The roof principals illustrated, are entirely of the low pitch type, but a mastery of the principles of their construction will enable the student to soon grapple the points of other forms. The method of constructing principals with wooden king and queen posts is now practically obsolete. The great number of joints results in considerable shrinkage unless constantly tightened up, resulting in sagged roofs and strained walls. Roofs of composite construction are now in general use, where at least the king or queen bolt succeed the posts of the same name.

The practice of battening walls for the sake of warmth and dryness is not mentioned and does not seem to be usual in English practice. It seems strange that in such a humid climate some more successful method than that of the hollow wall has not been introduced. The hollow wall does not thoroughly meet the necessities of the case, inasmuch as a certain proportion of the wall, as at piers, openings, &c., must be solid. The hollow wall has the advantage of permitting a more solid job of plastering and should be used in work likely to meet rough usage, but it cannot compare in dryness and comfort with the battened wall. The disadvantages of the latter are, however:—1st, the danger of conveying fire through several stories; and 2nd, the opportunity for the free passage of vermin. Both these contingencies however can be avoided by proper breaks or stops at all floors and ceilings, either by sailing courses of brick, or by horizontal battens at the ceiling and floor line.

Mitchell's chapter on joinery conveys practically all the information necessary in the ordinary experience of an architect's office, and a careful perusal is recommended.

The following is an outline of the work with which the 1st and 2nd intermediate students should be familiar in connection with the coming examinations on "The Elements of Building Construction:"

The various bonds in brickwork in ordinary use, offsets in footings, gauged arches of various forms and inverted arches, trimmer arches for fire-places, corbelling.

Sketches of mason work showing uncoursed and coursed rubble; ashlar and the proper bonding of the same; window sills, stone heads, strings, copings and quoins; methods of connecting stone by cramps, dowels and joggles.

Show how to scarf, mortice, tenon and build up timbers as applied to plates, roof timbers, beams and partitions.

Draw simple roof truss, king or queen post or rods, with details of framing and iron work.

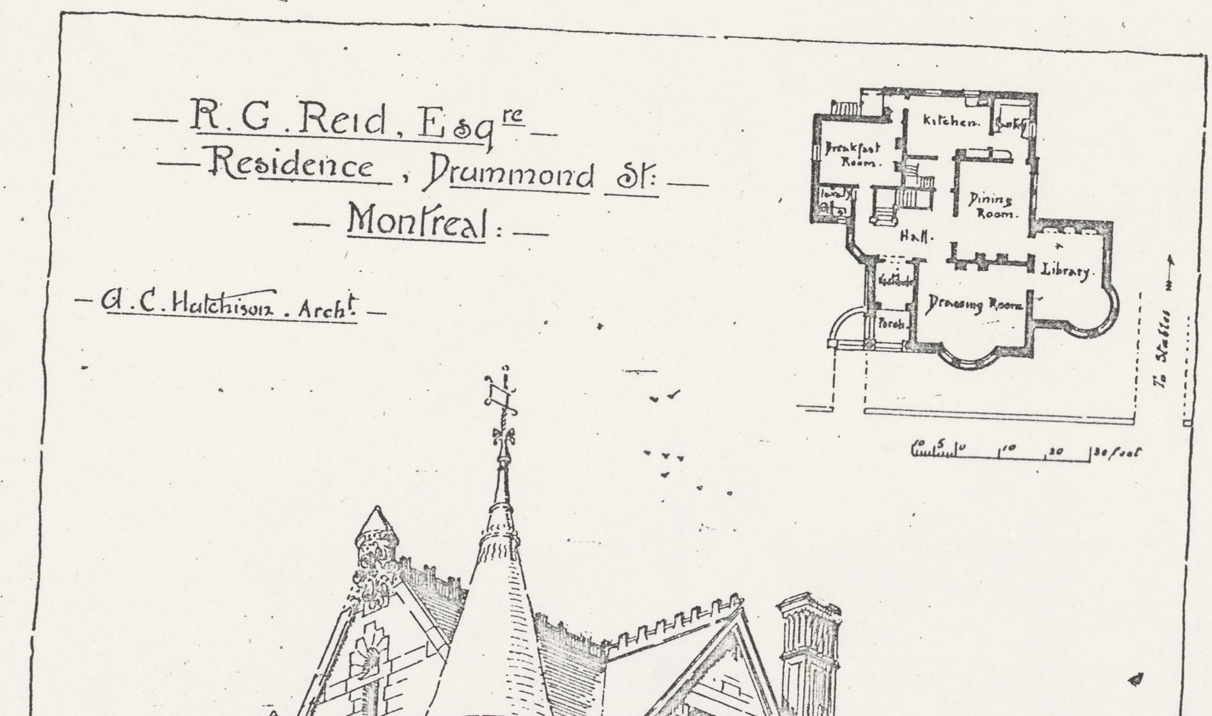
Draw floor beams, joists, trimmers and coverings, or floors single and double: a framed partition with a door opening in it.

Draw a section of door and window frames, the latter boxed, casement or lead glazed; section and elevation of plain, panelled, moulded, raised panel and bolection moulded doors.

Show how to flash on a felt and gravel roof, and also the flashings of a sloping roof at parapet walls; also construction of gutters suitable for this climate.

In the Second Intermediate the student should also be able to draw sections of various forms of cast and wro't iron columns, the latter built with Z bars or angle iron; section of head and foot of superimposed columns showing method of connecting.

Explain the various strains to which iron is subjected in buildings.


— R. G. Reid, Esqre —
— Residence, Drummond St. —
— Montreal: —
— A. C. Hutchison. Archt. —
Kitchen.
Breakfast Room.
Dining Room.
Hall.
Library.
Drawing Room.
Porch.
To Stables
CAN. PHOTO. ENG. BUR.

#3

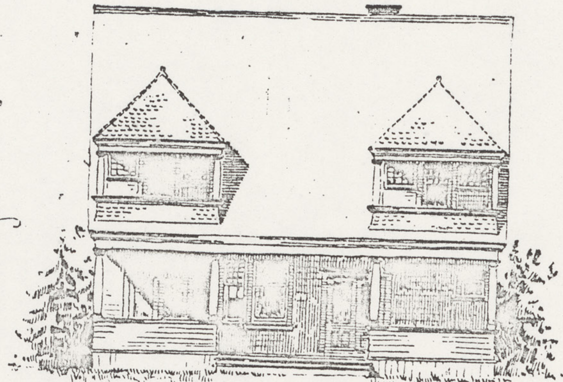
Sketch of.

Summer Cottage at Toronto Island

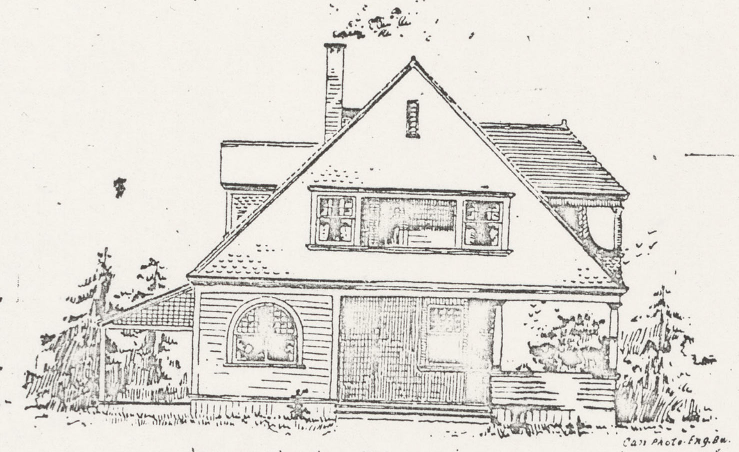
for Chas. E. Good Esq.

Scale — 8 feet to an Inch

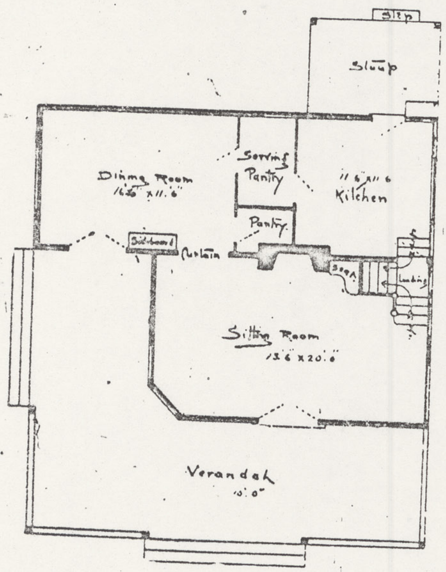
Langley & Burke. Archts.



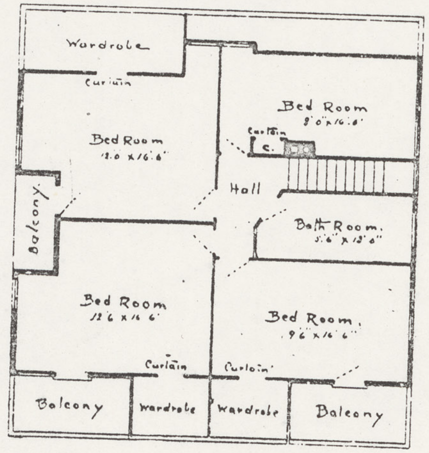
Front Elevation



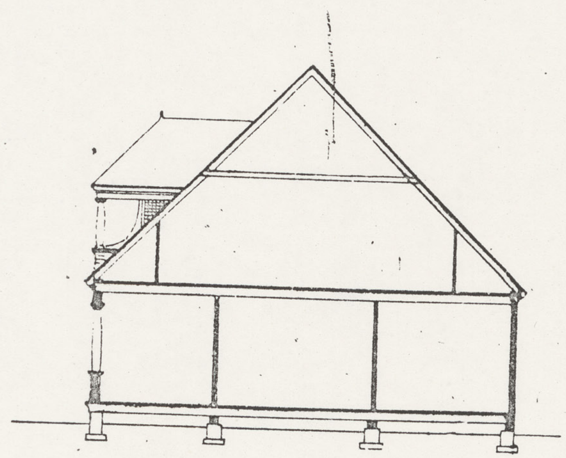

Side Elevation



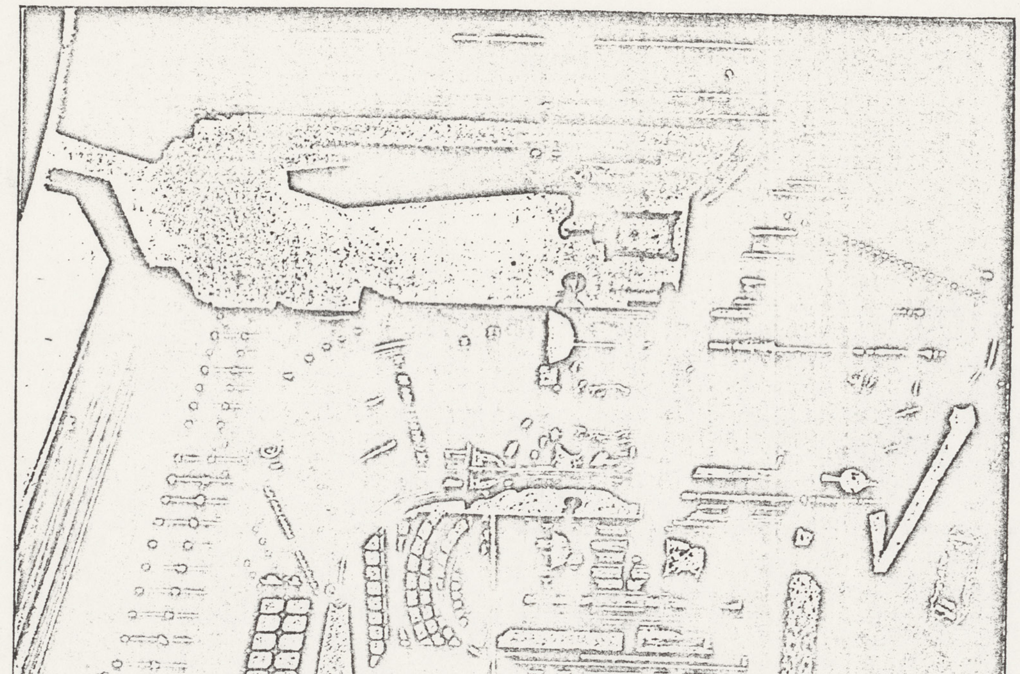

Ground Floor.




First Floor



Section



Interior of Hall, F. D. Monk's Residence, Montreal.

J. W. & E. C. Hopkins Architects, Montreal.

Show section of wro't iron girders and connections of cross beams; proper method of anchoring beams to walls.

Show simple composite and iron ro of and other trusses, with details of connections.

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"STRUCTURAL IRON WORK."

A Flitch girder is composed of two or more sticks of timber with a wrot iron plate inserted between the wood and bolted. This form is now practically obsolete as the rolled iron or steel beams cost little if any more. Cast iron girders are also practically obsolete, being limited to very short spans in the form of lintels over door or window openings, and are unreliable owing to the possibility of hidden defects in castings, resulting in collapse in case of a sudden shock, or in case of fire, when they will crack on the first application of a stream of water. They should never therefore be trusted without a relieving arch above.

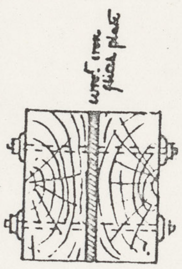


Fig 1

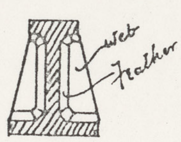



Fig 2

The sectional form of a cast iron girder should be different from that of one of rolled iron. The lower or tensional flange should be 4 to 6 times the area of the upper or compressional, as cast iron crushes with an average weight of 45 tons per square inch, and fails in tension with a pull of from 7 to 8 tons per square inch. Mitchell gives the depth of from 1-10th to 1-15th of the length, and the compressional flange 1-30th to 1-40th of the length. Wro't iron girders are much more reliable than cast, although they will yield by bending under a high temperature, such as is reached in a burning building. The difference in strength between compression and tension in wrot iron is so small that little or no attention need be paid as to the comparative dimensions of the upper and lower flanges, except in very heavy work. Wro't iron crushes with an average weight of 17 tons per square inch, and fails under a tension of 22 tons.

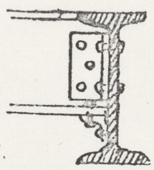
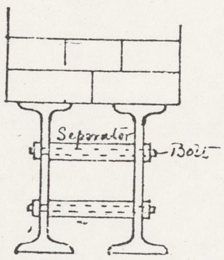


Fig 3

When one girder is not sufficient to carry the weight required, two of the required stiffness are placed side by side, and their relative positions retained by separators, which may be of cast iron with holes for the bolts to pass through, or they may be of short pieces of wro't iron pipe cut to the required length through which the bolts are passed. When girders over 12" to 15" deep are necessary, they are usually built up with rolled iron plates with angle iron connections or stiffeners. In the construction of columns, cast iron is the most largely used material, although rolled iron is being used more freely, especially in the construction of tall structures requiring the largest proportion of strength in comparison with space occupied. In these structures it is absolutely necessary that the material should be flawless and capable of resisting torsion and other strains which would snap cast iron and bring the structure to the ground. Columns of wro't iron will not resist heat as long as cast iron and consequently must be protected from the effects of fire when they have to carry important weights. The forms of wro't columns are numerous, the Z bar being the basis of those most used. Cast iron is so subject to flaws, often times hidden, that a large excess of material has to be provided in order to guard against failure.



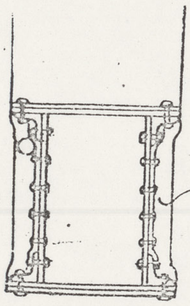




Fig 5

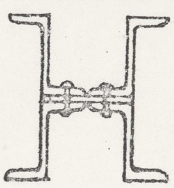


Fig 6

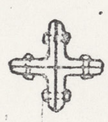


Fig 7

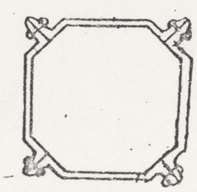


Fig 8

A column which may appear perfect on the surface may be little stronger than cardboard. One side may be 1½" thick and the other only ⅛th, or what may appear to be only a slight ridge or depression may be a serious defect, called "cold shot" leaving the column practically open on one side.

No column may be pronounced safe unless it is drilled in several places in order to test the evenness of the thickness of the metal. Cast iron columns are of various forms, circular, however, being the strongest in proportion to the weight of metal used. Whenever possible, the webs or flanges should be reinforced with brackets or stiffeners at frequent intervals, and there should be no abrupt internal angles or transition in form. Castings should also vary in thickness very gradually. Cast iron should not bear upon cast iron when carrying any important weight without the bearings being turned or faced in order to remove any lumps or inequalities from their surface to give them an even bearing. Plates or caps should have a raised rim so that when the bearing is turned, the unfaced surfaces will still be removed from contact. Iron roof trusses are now composed entirely of wro't iron, except the foot, which is usually of cast iron. The following forms are outlines of typical trusses. The joints are made with flat plates rivetted to the webs of members in compression and drilled for pins receiving ends of tension rods.

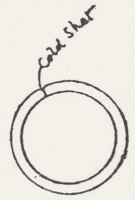



Fig 9

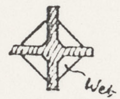



Fig 10

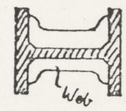



Fig 11

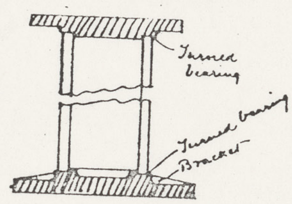



Fig 12

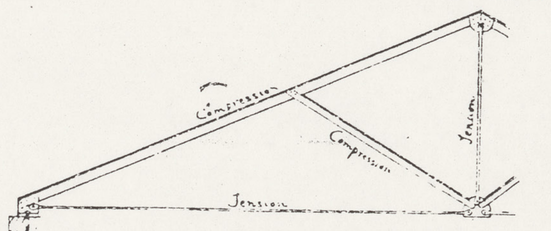



Fig 13

Trussed beams in ordinary practice are generally composite in structure, the ironwork being confined to cast iron shoes and wrot iron tension rods and the necessary bolts.

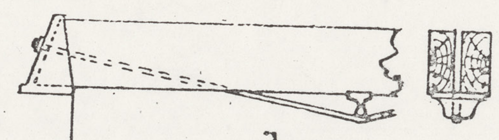


Fig 14

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## PERSONAL.

Messrs. Tripp & Wills, architects, have opened an office at New Westminster, B. C.

Mr. O. A. Graydon, city engineer of London, Ont., has been elected a member of the Canadian Society of Civil Engineers.

Messrs. R. C. J. Dunn and J. C. T. McKean, architects, St. John, N.B., have recently formed a partnership under the name of Dunn & McKean.

Mr. Joseph Hobson, chief engineer of the southern division of the G.T. R., has been appointed a member of the council of the Canadian Society of Civil Engineers.

Mr. John Miller, of the Pease Furnace Company, Toronto, formerly of London, has accepted a position with a large furnace firm in Chicago, and leaves for that city shortly.

The name of Mr. Geo. Gouinlock, of Toronto, was inadvertently omitted from the list published in our last issue of architects present at the annual convention of the O. A. A.

Mr. M. B. Aylesworth, Architect, Toronto, has just returned from a four months tour in Great Britain, the continent and the United States. He describes his trip as a most enjoyable one.

Mr. Geo. Theodore Bertheron, the oldest portrait painter in Canada, died in Toronto recently. He was born in Vienna, in 1806. He was the oldest member of the Ontario Society of Artists and was also an associate of the Royal Canadian Academy. He painted the portraits of many eminent Canadian jurists and parliamentarians.

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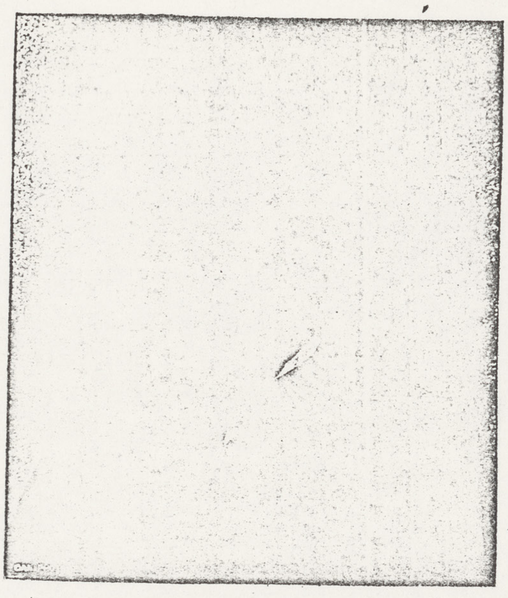
The Standard Drain Pipe Co., of St. John, Que., are adding to their plant a 125 h. p. engine.

## MR. JOHN KENNEDY, M. I. C. E., M. C. S. C. E.

JOHN KENNEDY, Chief Engineer of the Harbour Commissioners of Montreal, elected in January last as President of the Canadian Society of Civil Engineers, is a native Canadian, having been born at Spencerville, Ontario. He has for many years been a member of the Institution of Civil Engineers, England, and also of the American Society of Civil Engineers, as well as a charter member of the Canadian society.

Mr. Kennedy, in his long and active career in engineering, has had a variety and compass of experience that fall to the lot of but few in the profession—in fact, that can fall to the lot of those only who are gifted with rare powers.

A very brief and imperfect summary of the steps by which he has risen from a pupil in the office of Mr. Thos. C. Keefer, Past President of the Can. Soc. C. E., at the age of 15, to a foremost place in the highest rank of the profession, may be mentioned. His experience in municipal engineering was gained in the city of Montreal, where at an early age he was deputy city surveyor; in mining engineering, as manager of the Hull Iron Works; in railway engineering, when in four years he rose from being division engineer on the Wellington, Grey and Bruce Railway, to be chief engineer of the Great Western Railway, when at the summit of its activity and expansion; in the specialty of water works, in which he has been more or less intimately connected with nearly all the larger water works in the Dominion; in consultation or designing outright, as in the case of the pumping machinery of the Ottawa water works which, as an example of design would alone establish a reputation; in mechanical engineeing in general, in which he is a recognized authority, having been widely consulted in various kinds of mill machinery, and in dredging machinery, his designs being found on the Pacific and the Atlantic, on the waters of Oregon, Charleston, New York and the St. Lawrence. In general hydraulic engineering he is also an authority, his advice having been sought by the Dominion and Provincial Governments and a wide range of municipal corporations and private companies. He has managed the deepening of the St. Lawrence ship channel, and still conducts the Montreal harbour works with marked ability. On arbitrations and commissions his experience and counsel are constantly in demand, as, on the Trent Valley Canal Commission, the Lachine Canal Commission, the Commission on remeasurement of construction work on the Canadian Pacific Railway, the Montreal Flood Commission, and many others, and as an expert he has been frequently called before the committees of the Privy Council.



JOHN KENNEDY, ESQ., C. E., MONTREAL.

Mr. Kennedy's assistance has ever been freely and fully given to any professional brethren who have asked his advice. His ability as an engineer, his integrity as a man, and the extent of his reputation at home and abroad, give the assurance that in electing him President of their Society, the civil engineers of Canada not only honour themselves and him, but advance as well their own interests and standing as a professional body.

## ORNAMENT IN ARCHITECTURE.

ORNAMENT is extremely useful in conferring on buildings a degree of elegance and richness which, without it, would be difficult to obtain; and it also may be made to convey an impression of wealth and magnificence which, in its absence, could only be attained by increased dimensions or massiveness, which would be as expensive and, in some instances, at least, less effective. Ornament is also extremely useful in altering the apparent proportion of buildings. Thus, by the employment of strongly marked horizontal lines, a building which is too tall may be reduced to proportion; one that is too low made to look nearly as high again by employing only vertical features. Buildings that from the inherent necessities of their construction look weak may be made to appear of any desired degree of strength, and sparkling gayety of effect be given to those that otherwise would be too massive and heavy. Internally the architect very often cannot control the dimensions of his apartments, but by a judicious application of ornament he may always make low rooms look higher, narrow rooms broader, and reduce long rooms to a better proportion. More than even this, ornament enables an architect to give to every part of his design exactly that degree of prominence and dignity, and that class of expression, which suits its position or purposes. These are all legitimate uses for the employment of ornament, and when used for these purposes it is never offensive. It always becomes so when it is employed to conceal either use or construction, or to make a building try and look like what it is not or cannot be.—*Scientific American.*

## HEATING AND VENTILATION.

Mr. S. G. Curry, who has been appointed examiner in the above subjects in connection with the O. A. A examinations, recently addressed the members of the Toronto Architectural Sketch Club substantially as follows:

I propose to treat my subject in a very general way and not to go into detail to any extent; my object is to discuss heating, but as ventilation is largely bound up with heating it is impossible to treat of the one without the other.

The ordinary fire-place was the first method of heating adopted in our houses, and while it might not have been the most satisfactory method of warming a room, it answered most satisfactorily the purposes of ventilation. A fire-place warms a room by radiation, the heat rays passing through the air and warming the walls, floors, ceilings and any other articles which may be in the room and within range of the fire.

The next method was that of stoves, which warmed the rooms to a slight extent by radiation, but principally by convection or the heating of the air by passing over the heated surface of the stove.

Stoves gave place to furnaces placed in the basement, which heated large quantities of air to a high temperature, the air thus heated being conducted by means of pipes to the different rooms to be warmed.

The ordinary hot air furnace has developed, until we have different forms of hot air, steam and hot water combination furnaces, the object of the combination furnaces being to heat the central portion of the house near the furnace with hot air and the more distant parts with steam or hot water radiation.

Hot water heating is a favorite method. In this system water is heated in a boiler, placed in the basement and conveyed by means of pipes to radiators placed in the rooms to be heated. The heat which has been absorbed by the water is given off through the radiators placed in the rooms. Indirect heating by hot water is used to some extent; the air being brought in from the outside, warmed by passing through a heater placed in the basement and conveyed through the pipes to the rooms above.

Steam heating in its general principle is very similar to the hot water method, there being a boiler in the basement with radiators placed in the rooms to be heated, the steam being conducted from the boiler to the radiators and the water resulting from condensation being returned to the boiler through pipes. With steam, indirect heating can be used most satisfactorily.

It may be well to consider the advantages and disadvantages of the various means of heating our buildings. The fire-place is only of service in small rooms, and in this climate is altogether inadequate except in mild weather. The fire-place has these advantages: It heats entirely by radiation, and consequently does not raise the temperature of the room above a reasonable and healthful degree; it is also an effective means of ventilation, as all air required for the combustion of the fuel is withdrawn from the room, thus causing an inflow of fresh, pure air. Its principal disadvantage is, that owing to the fact that the fire-place warms a room by radiation a person sitting near the fire may have the portion of the body exposed to the fire extremely warm, while the rest of the body is proportionately cold. This effect is caused by the heat's rays striking the portion of the body exposed to the fire, while at the same time the temperature of the air in the room may be very low owing to the walls being cold. The air in the room can only be warmed by coming in contact with the surfaces of walls and furniture which have become warm through being within range of the fire and thus receiving heat by convection.

Some manufacturers and dealers have been selling low down grates, claiming that they warm a room better than a grate set high up. Such is a mistake, because when the fire is set low down near the floor, the heat rays cannot strike the floor except at an angle so obtuse that the floor derives very little heat from the fire. A high fire will throw the heat rays at a less obtuse angle, and will consequently warm the floor better. The heat rays from a low fire will pass over the floor in almost parallel

lines. In countries where the fire-place has been depended upon for heat, many very ingenious grates have been invented with the object of warming the air in the rooms by passing it around the fire and discharging it back into the room, or for taking fresh air from the outside of the house and discharging it into the room after passing it around the back of the fire-place. Grates of this description have not come into use in this climate as they would not be able to warm the rooms properly, and consequently some other means of heating must be adopted which is generally sufficient without the assistance of the fire-place. We thus lose the benefits of the ventilation which always results from the use of a fire-place, even though it has no special arrangements for supplying fresh, warm air.

Very little can be said in favour of the method of heating by stoves, except that it is capable of economically heating rooms to a very high temperature. A stove heats a room slightly by radiation, but principally by convection, as already stated. The walls and floors remain comparatively cold as they receive no radiated heat, and the contact of the warm air does not warm them in any degree equal to that radiated from a fire. The reverse is the case—the walls through being colder chill the air of the room. There is a slight amount of ventilation caused by the withdrawal of the necessary amount of air to support combustion in the stove. Fresh air, as in the case of a fire-place, comes in through cracks and crevices in the windows, doors, etc. A great number of arrangements have been made whereby ventilation may be secured with the use of stoves. The stove pipe has been placed within a second pipe so that the heat from it would induce an outward current between the two pipes, thus ventilating the room. Casings have been constructed around stoves, so that the air to be warmed was made to pass up between the stove and the lining. This was first done with the object of drawing the cold air from the floor and warming it. After a time the casing was carried down to the floor with a number of holes near the base, through which the cold air might be drawn, and at the same time a pipe was put in which connected with the outside air. The fresh cold air entered through this pipe, and was discharged under or at one side of the stove in such manner that it was warmed between the stove and the casing. With slides covering the openings into the room at the bottom of casing and with the dampers in the pipe supplying fresh air, it was possible to regulate the temperature of the room to a nicety, for if the room got too warm, by closing the slides at the bottom of casing and opening the damper in the fresh air pipe the temperature could be lowered very rapidly, or if the room got too cold, by closing the dampers and opening the slides the temperature could be raised very quickly. Many modifications of the above arrangements were brought into use, and in the majority of cases were found to be satisfactory. Having adopted the casing around a stove, placed in the room to be warmed, it was but a short step to place a stove with this casing in the space adjoining the room to be warmed or below it. Thus by degrees the hot air furnace became a reality. An ordinary stove with casing was placed in the basement, and as it was found to be satisfactory for the heating of one room, it gradually came into use for the purpose of heating a number of rooms. As a result, the small stove gave place to a larger one and the large stove to the furnace, which is really nothing more than a stove specially designed for the work which it has to do.

The principal benefits to be derived from the use of a hot air furnace are the doing away with a number of fires placed in stoves for one large fire, with a consequent reduction in attendance, and the bringing of fresh air into the house, which provision is always made in the erection of a furnace. If the furnace is of ample size and the fresh air opening left open, a house warmed by the means of a hot air furnace will be reasonably well ventilated. The air in a house heated by a hot air furnace may be very impure, not because the house is so heated, but because the apparatus is improperly managed or is defective. If the occupant objects to burning the necessary fuel, closes the fresh air inlets and draws the furnace supply of air from the house, he cannot expect very pure air. He is simply making his heating system correspond to a stove in his room without a supply of fresh air. The air of the house is carried through the furnace over and over again. When it becomes cold it drops to the floor and from the floor is carried through the furnace, where it is warmed and again discharged to the different rooms to be warmed.

The principal point to be observed in setting up a hot air furnace in a house is to put in a furnace of large size—the larger the better. A large furnace will be more economical than a small one; even an excessively large furnace will not burn any more fuel than a small one. If a small furnace is put in it will be possible to keep the house warm in mild weather by ordinary fires, but in cold weather the furnace will have to be driven beyond its capacity. This driving of the furnace means that it becomes over-heated and possibly red hot, and the air passing over it is heated to a temperature far too high. If air is heated much beyond 140° F., it is positively not in a proper condition for breathing. All its vitality has been abstracted, and it is so dry as to absorb moisture from any and every substance in the house, thus causing the woodwork to shrink to an extent which one would not think possible, besides abstracting moisture from the occupants of the house to their serious injury.

Having arranged to put in a large furnace, in what portion of the house should it be placed to give the greatest satisfaction? In this climate where the prevailing winds are from the north-west, the furnace should be placed towards that side of the house. If it is not so placed it will be found very difficult to get any warm air into the rooms which lie north-west of the furnace, the warm air going almost entirely to the rooms on the opposite side. The furnace should not be placed too far from the centre of the rooms to be warmed, as it is possible to go to the opposite extreme and find that the rooms to the south-west of the furnace cannot be heated, because the air has to be carried through too great a length of horizontal pipe. At times we have very cold east winds, which makes it difficult to warm rooms with an easterly exposure, and if the furnace is placed too far from these rooms it will be impossible to heat them under such conditions. A hot air furnace requires for its satisfactory working that there should be some means of withdrawing air from the house. In the ordinary house a very large amount of air escapes by means of cracks and crevices around windows and doors, about the base boards, and also to some extent through the walls. The best way to arrange for the discharge of impure air is by the means of a fire-place which will withdraw the cold air from the floor, which is the proper point at which ventilation should be sought in a furnace heated house. Those fire-places which have flues in inside walls will nearly always be found to be withdrawing air from the room in which they are placed. A fire-place with a flue in the outside wall cannot be depended upon to withdraw air except a fire is burning therein. For a compactly built house of ordinary size, a hot air furnace is a very satisfactory means of warming, provided it is of ample size and there is a proper number of fire-places in the house. Of course it is to be understood that the furnace, hot air pipes, ducts, etc., have been put in by a man who thoroughly understands hot air heating.

The hot air furnace has been modified to some extent by the addition of hot water or steam heating in combination. This was first brought about by hot air furnaces being placed in houses having rooms so situated that it was impossible to heat them from the furnace. It occurred to some one that if a coil of pipe were placed within the fire pot of the furnace and connected to several radiators placed in those rooms which could not be heated by hot air, the difficulty would be solved. This arrangement was adopted in its crude form, but was not considered satisfactory by those who understood its drawbacks. The principal and most serious objection was that two openings had to be cut in the furnace which could not be closed tightly and which consequently allowed the gases of combustion to escape from the fire pot into the space surrounding the furnace and from that space into the house. It was also necessary to put on considerable amount of radiating surface, for if such was not done and the furnace was fired hard, trouble was almost sure to arise through the over-heating of the water in the coil and pipes. The idea was taken up, but instead of having a hot air furnace with combination hot water heating, a hot air and steam combination furnace resulted. This furnace was made of wrought iron with a steam generating chamber at the top of furnace. The air was warmed in the usual way by being passed over the outside surfaces of the furnace, and the steam was generated in the chamber above the furnace by passing the hot gases through vertical tubes as in a vertical steam boiler before allowing them to escape into the main flue. The central rooms were heated by hot air, and the rooms at a distance on the exposed sides of the house by radiators, which were supplied with steam from the chamber at the top of the furnace. This style of furnace is very satisfactory, provided it is properly put in and too much work is not expected of it. Lately a hot air and hot water combination boiler has been invented. It is really a hot water boiler, as it does nearly all the heating by means of hot water, the warm air being auxiliary to the hot water. The fresh air is made to pass around and over the boiler and is then allowed to escape into those portions of the house which are deemed to require plenty of fresh air. This form of boiler is not able to heat more air than is absolutely necessary to keep a house supplied with sufficient fresh air to maintain a reasonably healthy condition.

The next method of heating with which we will deal, is that of hot water as it has been practised for several years past. The boiler is placed in the basement, and flow and return pipes are run to radiators placed in the different rooms to be heated. The pressure on the system is that due to the head of water given by the height at which the expansion tank may be placed. The pressure at the tank, of course, will be that of the atmosphere. The pressure at the boiler may be 15 or 20 lbs., or even higher, in the case of a very high building. With this system it is practically impossible to get the water at any time much above 212 degrees, for if it should be heated higher than that it will change into steam at the expansion tank and blow off to the atmosphere, having its place taken by fresh cold water which will lower the atmosphere of that in the boiler and pipes very quickly. Some years ago nearly every radiator had its independent supply and return mains, or at the most there were not more than two or three radiators fed from the same main, and they were invariably placed at the same level, so that they would feed equally well. Of late years the tendency has been to place more radiators on

the same feed pipe and use great care in seeing that the connections were so made that each radiator would get an ample supply of heat. At the present time the tendency is to run mains for hot water heating very much on the same principle as steam mains are run. This method has been found satisfactory if the hot water engineer is thoroughly acquainted with his work and understands the principles governing hot water regulation. In the hands of an ignorant mechanic the results would be most disastrous. In very good and elaborate work the mains are valved so that it is possible to cut the heat off in any portion of the building without the least interference with the working of the balance. With hot water heating a steady uniform temperature can be maintained at all times with very little trouble. There is very little improvement in hot water heating over that derived from stoves, except that due to the fact that the air in the house is heated on a very large surface at lower temperature. It is the same air which is warmed over and over again, except whatever may come in through cracks and crevices owing to the difference in pressure between the cold outside air and the warm air in the house. As a rule nearly all the hot water heating has been done without any attempt at introducing fresh air.

Indirect hot water heating has been tried in this climate but with little success. The risk from frost is very great, and if the heater should become frozen the damage done is by no means light. It is possible during the day to have the benefit of indirect warming, when the fire can be kept burning brightly and there is some one to watch the heaters, dampers and fresh air supply, but to allow indirect heating to be continued during the night is exceedingly dangerous, because the outside temperature may drop very low and the fire under the boiler may become burnt out, in which case the heaters would freeze very quickly and cause a large amount of damage. I am aware that indirect hot water heating has been tried, and that according to the statement of those who have put it in, it has been found satisfactory. A careful examination of every so-called indirect hot water system will show that in nearly every case the air is supplied to the heater from the basement, and not from the outside, as soon as the weather becomes at all cold. In fact there are indirect hot water systems where the air is never taken from outside the house, but is brought from the basement at all times. It is possible by a very carefully arranged system with a very large boiler surface and great care on the part of the attendant, to pass a plentiful supply of fresh air over hot water pipes in the ordinary way, but the safest, most economical and satisfactory method is to build a brick enclosed space of such size as may be necessary, similar to that surrounding a hot air furnace. By placing a large quantity of pipe in deep coils, cold air may be warmed with a reasonable degree of safety. Fresh air should be brought in at the bottom of the space, with the opening so arranged that the incoming air cannot blow on to the hot water coils. Tin pipes are then taken from the sides of the enclosed space to the different rooms to be warmed. By arranging several of these warming chambers, according to the size of the house, a house may be fairly well warmed by the indirect system without much danger of damage from frost. There will have to be less or more direct heating surface in every room to be used in cold weather, as it will be found impossible to keep a house warm by the indirect hot air plan, as it is impossible to pass a large volume of very cold air through the heating coils. Hot water heating in an ordinary sized building will be found very satisfactory, but when the building is very large, steam heating will give better satisfaction.

The steam heating system is very similar to the hot water system in general outline. There is the boiler in the basement with supply and return mains to radiators placed where heat is required. A steam boiler may be of any size from a small portable one to a very large boiler similar to those used for generating steam for power purposes. In steam heating on the gravity principle there is but one large supply main and corresponding return back to the boiler. The steam is taken to the different radiators by means of branches from the main supply, and the water of condensation returned in like manner to the main return.

With a steam plant it is possible to have a first-class indirect heating job. The indirect heaters are generally placed in the the basement below the rooms which are to be warmed with a hot air flue running up to the rooms to be warmed. The fresh air may be supplied to the different indirect heaters by means of one or more common fresh air ducts, or an independent supply may be brought to each heater. The latter method, if it is possible, is the better to adopt, as each heater having its own supply will always have the necessary quantity of fresh air. With one common duct, if the system is not very carefully arranged, the heaters which supply air to the rooms on the upper floors will draw such large quantities of air as to practically rob the heaters to the ground floor. In bringing fresh air into the heaters it is necessary to arrange checks in such a way that cold currents of air can not be driven upon the radiators. The fresh air should rise slowly to the bottom of the heaters through an ample opening. Where the air is brought from the outside separately to each heater, it will be well to take it low down towards the floor and then allow it to ascend to the heating chamber. The supply and return pipe to radiator should be so run that they will be outside of the heating chamber and cold air supply. If the return main is dropped down within the cold air supply or near it, there is a possibility of it freezing. There is little to fear from frost with the indirect steam radiators placed in the manner described above, even though the cold air opening should be fully open and the steam in the boiler run down, as there is nothing to freeze beyond a small amount of vapor. It is seldom satisfactory to attempt to heat two rooms from one radiator. It is always better to have the radiator proportioned to the size of the room to be warmed and take from it one hot air pipe. The action is then positive, there being no possibility of one pipe drawing all the air and leaving the other pipe inactive, or with a possible down current in it to the radiator.

Steam heating is generally done on the gravity system where the plant is put in for heating purposes only. Where there is a boiler used for power purposes, steam may be taken from it and reduced down so that it can be used with perfect safety and with good results in the ordinary gravity system of piping by returning the condensed water to the boiler by means of a pump. In such cases it is usual to make arrangements to use the exhaust steam from the cylinder of the engine with the back pressure valve set so as to keep a small pressure in the steam mains.

In large buildings where it is possible to have the steam plant thoroughly designed and with a surplus boiler power, very satisfactory heating may be had with steam, but where the boiler is not of large size and has a small amount of heating surface, it is very difficult to maintain the heat at anything like an average temperature.

## HOW TO ESTIMATE.*

By W. H. HODSON.

FOLLOWING is the remaining portion of the specification and bills of quantities accompanying the drawings of Public School on Gladstone Avenue, Toronto, published in the CANADIAN ARCHITECT AND BUILDER for February :

### BLACKBOARDS.

Provide and fix ground work of blackboard on sliding door composed of six sheets of ⅛ thick teather board 30 in. x 36 in. jointed and glued on to large door panel 36 in. x 15 ft. long, and left in readiness to receive composition paste to be put on by the School Board. (This leather board can be procured from the establishment of P. Jacobi, 5 Wellington St. east, city, at 15 cents per pound.) At the platform end of seven class rooms there will be slate blackboards 4 ft. high and 16 ft. long, composed of four slates ⅝ of an inch thick, jointed and packed and fitted to an even and true surface, and to be of Rockland slate of best quality, and to be approved by the architect and the inspector of city Public schools. These slates to be secured in position by wooden stop screws or with round head screws. Provide and fix moulded casing around all blackboards, both slate and plaster composition, in all class rooms, also ⅞ x 3 in. ground at back of slate board. The casing around blackboard to be 4 x 1⅜ in., and to cope into side of architrave and to be moulded in same manner. For amount of composition blackboards see plasterer's specifications. The blackboards will extend along both sides and ends of each class room. The carpenter's tenders are to state the deduction of the slate if not required.

### BRICKWORK.

All brick used in the works are to be of the best quality of Carlton brick, and (except otherwise specified) to be of a deep red color and to be hard and well burnt and free from lime and other defects. All outer walls and chimney stacks are to be faced up with "picked" hard and deep red colored "face brick." No soft brick will be allowed in the work, and are not to be brought upon the ground, but if any should be brought there, they are to be immediately removed. The mortar is to be composed of the best quality of coarse, clean sharp grit sand, and fresh burnt lime, in the proportion of 2½ of sand to one of lime, mixed with a proper quantity of clean water and thoroughly incorporated and tempered together. Build all brick walls as shown upon drawings and in accordance with the dimensions figured on plans and sections. The brickwork is to be laid up so as to guage four courses to every 11½ in. in height, and to be carried up uniformly throughout the building. Every course of brick is to be laid in a full bed of mortar, and to be thoroughly flushed in with mortar at all cross and other joints. The walls are to be built in English bond for all partition walls, and for the inner portion of all external walls, but the outer face of all external walls is to be built "American" or "Stretcher" bond, the face brick being clipped to receive diagonal binders continuously on every 5th course. The walls and chimney stacks are to be carred up plumb, square and true, built to a line on both sides, particularly the face of all outer walls which are to be built fair and true, with each and every course laid with close and level joints. The inner face of outer walls are to be finished for plastering on; also both faces of all inner or partition walls in same manner. All the outer or foundation walls of basement are to be lined up with brickwork one-half brick or 4½ in. in thickness, tied into the stone work with a double heading course at the floor line, midway up, and at ceiling line of basement, and midway between these double heading courses to have a single heading course, making three double and two single heading courses for the whole height of basement storey. This brick lining will be composed of the best quality of picked hard grey brick, laid with level and fair close joints well bedded in mortar and the joints neatly struck with the trowel. The partition walls in basement, also the chimney breasts, are to be faced up "grey" brick, as above described, and pointed in the same manner, as there will be no plastering on basement walls. The bricklayer will provide for and execute all brickwork in connection with the Smead-Dowd heating and ventilating apparatus as indicated by the drawings and in accordance with the plans and specifications of such heating and ventilating apparatus hereto appended. The bricks used in connection with the above mentioned heating and ventilating apparatus are to be of the very best quality of picked hard and well shaped, red and grey brick in such proportion as may be required, to be built in a shapely and workmanlike manner, with close joints, neatly struck with the trowel. The walls for the air chambers and furnaces will be from 9 in. to 13½ in. in thickness, and extending from floor to ceiling, and all built square, true and plumb. Build the large ventilating and smoke stacks as shown per plans, elevation and sections, and in accordance with the dimensions figured on same. These stacks are to be built with picked hard brick, and the inside of same carefully and thoroughly parged with mortar, and so as to render the same even and smooth inside,

* This series of articles commenced in November, 1891.

The upper portion of these stacks is to be parged with Portland cement, say the upper 6 ft. of same, and all the sailing and hose courses, capping and belfry archway, &c., all to be laid in Portland cement, and all the joints and weatherings made and pointed in the most careful and thorough manner. Provide and build in sheet iron smoke pipe collars, four of them (14 in.) diameter in smoke flues in basement, wire rimmed on the outside and 9 in. deep and rim round same with ½ brick arch. Provide and build in a cast iron plate division between the smoke and ventilating flues in each stack as shown per drawings, extending from the basement floor level to top of stack above roof. These plates will be ⅝ in. to ¼ in. thick, 2 ft. 6 in. wide, and from 2 ft. to 2½ ft. in height, each made with a groove along the upper edge of each plate. Provide and build in cast iron soot doors and frames to same in bottom of each smoke flue, 14 in. square or larger, and provide and build manhole doorway in bottom of each ventilating flue, say 2 ft. 6 in. x 4 ft., arched over and provided with a fine tooled or rubbed stone head, 6 in. x 14 in. x 3 ft. 6 in. long. Provide and build an air duct under the basement floor in each closet room (two of them) having an area of 12 ft. each inside, and the length required as indicated on drawings. These ducts will be about 3 ft. in depth by 4 in. wide, built with picked hard brick and laid in Portland cement mortar; to have 9 in. wall at one side (the walls of building forming the other side) and to have a brick bottom laid on the flat and grouted with cement. Connect these ducts with the ventilating flue at the bottom of same with an opening 3 ft. x 4 ft., capped over with a tooled stone cap 12 in. x 14 in. x 5 ft. 6 in. in length. The foundation of the walls of building forming one side of these air ducts, and through which the same has to pass to reach the bottom of ventilating stack, are to have the extra depth required for that purpose, viz., 3 ft. Build all hot air flues leading from the basement up to the ground and first floors as indicated by the drawings; to be built in the most careful manner and thoroughly and smoothly parged inside with mortar. Build in all register frames and collars, &c., furnished by the contractors for heating apparatus and as indicated by the plans of heating. Provide and build in ¾ in. round by 8 in. long, climbing irons in the brickwork of ventilating flues, every 6th course in height, alternately on each side of flue and placed about 9 in. from one end of same. Also provide and build manhole opening into each ventilating flue immediately above the attic joists, say 2 ft. 3 in. x 4 ft. high, with two rimmed arches over same on 2 x ½ x 4 ft. iron bar, and set frames to same pointed by carpenter. The rear basement wall will on any future extension of the building become an inside partition wall, and will therefore be built entirely of *brick* instead of stone, and will be of picked hard burnt brick carefully selected and the face bricks laid in Portland cement. This wall will be 18 in. in thickness, as figured on drawings. Build area walls of picked hard brick to rear entrance and rear basement entrance steps, as shown per drawings; also brick parapet walls at side of steps, and provide and build in ¾ in. x 18 in. iron anchor bolts (27 of them) with ½ x 4 in. cross piece at bottom to secure coping to above walls. Provide and build parapet walls of brick to side of front entrance steps, as shown per drawings, and provide and build in ¾ in. bolts (12 in number), 6 to each set of steps to anchor down the coping to same and as described for coping to rear steps. Build all belt, string and sailing courses, pilasters, &c., to outer walls, as shown per elevations; also all aprons to underside of window sills, the latter cut and rubbed to shape indicated and as per details to be furnished as required. Build water table plinth to base of brickwork, as shown per elevations, with the top course of moulded splayed brick with the top bed of same laid in Portland cement. Arches to window and door openings, also relieving arches in rear wall of building, to be 13½ in. and 9 in. in height respectively, as indicated by drawing; to be cut and guaged and with soffits rubbed and finished in best manner. Turn relieving arches two ½ brick rims in height to inside of all window and door openings to have a camber of not less than 6 in., formed on brick cores on top of straight lintels. Turn brick arches across the corridors on both stories as indicated by dotted lines on drawings, segmental in form and 13½ in. in height. The inside of front porches are to be faced up with picked, clean and even colored white brick laid stretcher bond in putty joints and lead jointed, and the inside arches showing in same porches to be finished in same manner; also that portion of outer main wall showing on the inside of porches. The outer face of all external walls (except the face of rear wall) will be dry tuck pointed in the very best manner, the joints being raked out full ½ in. deep as the work progresses, and when ready for the pointing to be stopped in with putty mortar specially prepared and colored a dark Indian red or other color to be selected and approved by the architect. The stopping for tuck pointing is to be colored with best "Venetian" red, and a sample piece of the work is to be done and approved by the architects before the regular work is begun. It is to be distinctly understood that a first class job in every respect is required, and that none other will be accepted by the architects. The face of rear wall is to be laid up with even colored brick with close and true joints and struck with the trowel in a neat and workmanlike manner. Beam filling is to be carried to top of joists and to roof boarding in all cases, and as to latter to be pointed with mortar so as to render the same air tight. Carefully and thoroughly flush into all window and door frames as the brickwork progresses, and carefully preserve the staying of all frames. Build in all bond strips, joists, plates, lintels, wood blocks, &c., required by carpenter, and build chases for water and waste pipes required by plumber. Provide and lay the basement floors throughout with concrete and Portland cement, and as follows, viz.: First clean off the earth floors removing all wood cuttings and other rubbish, and carefully level the ground, grading the same towards the weeping drains; then provide and lay over the whole surface of floors a bed of fine broken brick and coarse gravel well mixed together, to a depth of at least four inches, all well rammed down; then over this lay a bed of fine gravel (screened) one inch in thickness mixed with Portland cement in the proportion of one of cement to three of gravel, and over this float on a coat of Portland cement one inch in thickness mixed with clean sharp sand, in the proportion of one to two. The top coat of cement is to be floated to sand and trowelled down to a smooth and level surface throughout, and to be protected until thoroughly set. The cement floor in each room is to be graded to the centre and provided with a 6 in. cast iron grating connected with the drains underneath to carry off water when the floors are washed. All the above concrete and cement floors are to be executed with the very best of Portland cement and other materials, and in the most workmanlike and thorough manner. The contractor or contractors are to provide good and sufficient scaffolding, to be approved by the architects, and be left up for the other trades. He or they will conform to the requirements and provisions of the building by-laws of the city. The chimney stacks are to be tuck pointed as described for walls, in the most careful manner, and the stone base and cap set and pointed in Portland cement. As soon as the tuck pointing is done, or sooner if required by the architect, the contractor will remove all bricklayers' surplus materials, and all rubbish and plant from the premises, and will clean up the lot and such portions of the street fronts used by him, and will also clean out the basement and other flats of the building, removing from same all bricklayers' rubbish, surplus materials and plant, &c. The whole of the bricklayers' work is to be executed in the most thorough and workmanlike manner and complete in every respect, the contractor furnishing all necessary and proper materials, scaffolding, tools and labour, and executing all the works called for by the plans and specifications, comprehending what might reasonably be implied though not particularly mentioned in the specifications or shown on the drawings.

### CUT STONEWORK.

Provide and set all cut stonework required throughout the building complete in all respects, and as follows, viz.: All window sills to be of Credit Valley brown stone, 6 in. x 10 in., fine tooled and weathered on top and throated under, but to be rock face on the face and to project 2 in. from face of brickwork. All windows above the basement and all entrance doors to have 6 in. x 12 in. stone heads of Credit Valley brown stone, fine tooled on the soffit or under side, and to be back checked and picked to a face on the back side to fit to frames and lintels, but to be left rock faced on the front. The two basement rear entrance doors to have 12 in. x 6 in. tooled or rubbed Berea heads. The chimney and ventilating stacks will have 6 in. thick base and cap stone, as shown per elevations and sections; to be fine tooled and weathered on the top side and throated under. Cut left rock face on the edges. These cap and bases will be formed in the number of stones each as shown per details, to be cramped and leaded together and the joints set and pointed with Portland cement. The base stone will form the floor of belfry between the two vent stacks, and will have a 2 to 3 in. hole drilled through same and a piece of 2 in., 8 lb. lead pipe inserted in same and neatly dressed down and flanged to the stonework, and to pass down about three or four feet below for bell rope to pass through. Provide and set two Berea stone corbels 14 in. x 24 in. x 12 in. to carry the point of main rafters at side of ventilating stacks; to be tooled work. Provide and set fine tooled Berea stone sills to basement entrance doors, 6 in. x 4 ft. 6 in. x 18 in. The sills to rear windows are to be of fine tooled Berea, weathered and throated. Provide and fix inscription stone to front of building 21 in. x 6 in. and 14 ft. 9 in. in length, with the inscription "City Public School" cut in same in letters 9 in. high, inch wide and ¼ in. deep, and capitals 14 in. high, 1¼ in. wide and inch deep. This stone will be of Credit Valley brown stone, rock faced on the margin and fine tooled in the centre to receive the lettering. Provide and fix cap stones of rubbed Berea stone 3 in. thick, to cover the top of hot air flue projections on the two rear corners of building. There will be four of these stones, two of them 14 in. x 36 in. and two of them 14 in. x 48 in., to be weathered on top.

### GALVANIZED IRONWORK.

Provide best quality of "Iron" brand or Gospel Oak No. 26 B.W.G. galvanized iron, and form and execute and complete in the most substantial and workmanlike manner all the galvanized ironwork hereinafter described. The deck roof to be covered with galvanized iron formed in long sheets with joints made on 2 in. rolls with caps to same nailed and soldered, and with false or expansion rolls between same. Cross joints to be lock jointed and soldered in best manner. Turn the iron down 4 in. over slate and form moulding at junction of deck and slate roof as per marginal section, all well stayed, nailed and soldered, and with spring or wind seam along the slate apron. Line all vallies with galvanized iron, 20 in. in width, and under same lay one ply of tarred felt 30 in. wide properly nailed down. Lay apron of galvanized iron to all eaves 10 in. wide, turned up under slating and nailed to roof boarding and dressed down into eave troughs. Eave troughs throughout to be oval and fillet shaped, with back to same 4 in. above level of trough, all well secured to facia of cornice with long spikes through galvanized iron trales. Eave troughs to be well soldered at all cross joints. Down pipes to be Douglas Bros. patent octagon shaped, secured with patent hold fast spikes to brick walls, and to be carried down 2 ft. below grade of ground and banged and cemented into drain pipes. There will be six stacks of 5 in. octagon down pipes as above described, and two small stacks of same from the front porch roof; also four stacks of 4 in. round down pipe from play-shed roofs, the latter to have shoes to same to waste onto the planking. The main roof gutters to be 6 in. mou ded, the porch 5 in. do. and the sheds 5 in., all complete. Provide and fix 10 in. wide cloak flashings to all roofs abutting against brickwork; also continual aprons where required around the base of the ventilating stacks and belfry, the iron to be tucked one inch into joints of brickwork and wedged with iron wedges, and cemented with Portland cement, and dressed down and fitted neat and close to brickwork, and where practicable to be stepped with the brick courses. Provide and fix galvanized iron cresting (moulded) to belfry ridge in accordance with details, and flash same to brickwork; also moulded eave moulding to same as per drawings. All the galvanized ironwork is to be executed as expeditiously as the progress of the building will admit of, and in the most substantial and workmanlike manner, complete in all respects. Provide and cover the man-hole opening in deck roof both sides and top; sides 12 in. high and top about 3 ft. square with galvanized iron, all fitted and finished in best manner.

### SLATING.

Provide and slate the roof (excepting those of the play sheds) with the best description of Canadian slate from the Melbourne Quarries. Slates to be 10 in. x 20 in., laid on single ply of tarred felt with double lap leaving 10 in. to the weather. Each slate to be nailed with two galvanized iron nails, and to be laid with double row at eaves. Trim the slate to a line on both sides of all vallies, and cut and lay all hips with cut close chamfer and point same with slate colored plastic cement. Provide and lay 10 in. wide step flashings of galvanized iron to all slating abutting against brickwork, and in most careful manner. Carefully lay and close nail the tarred felting so as to cover the roof boarding at all points, and lay double straddle thickness of felting over all hips, vallies and ridges. Execute all other work necessary to render the slating complete in every respect. Examine the slating on the completion of the work of all other trades, and make good any broken or displaced slate, and clean out and remove all broken slate and cuttings of same from eave troughs and down pipes and vallies. Remove all surplus slate and cuttings, &c., from the premises on completion of the slating. The belfry roof is to be laid with round tailed red tiles laid in cement and all well cemented at joints and against brickwork.

### PLUMBING WORK.

Provide and lay in from street main, clear of frost and with stop and waste cock boxed in and packed, &c., ¾ in. 6 lb. lead water service to basement of building, with *separate* ⅝ in. 10 lb. branch service from same to the drinking stands in basement, lunch rooms and to ground and first floor corridors, and in all cases to be carried on neat dressed and moulded boards fastened to wall and ceilings, and where required to be cased in the woodwork provided by carpenter. The service pipes must be arranged so that the same can be emptied with proper stop and waste cocks. Provide and fix in each lunch room or basement one of Mott's patterns of cast iron enamelled drinking stands, No. 93 pattern, page 42 of Mott's catalogue, 1881 edition. Also provide and fit up in the recess next to ventilating stacks on ground and first floor corridors, Mott's pattern of cast iron sectional urinals (8 ft. long each) to be used as drinking stands, to be supported on proper dressed boards secured to wainscotting; see Mott's catalogue No. 257-8 pattern, page 127, edition of 1881; these drinking stands to have ⅝ best pattern self-acting spring cocks, nickel plated, two to each stand in basement and six to each stand on ground and first floors, (16 in all). Each stand to have 1½ in. 6 lb. lead waste and trap and screw

to same complete, and connected to drain under basement floor. The above described plumbing work to be of the most substantial character and finished in best manner, and to include sixteen heavy metal drinking cups with strong chain attachments to the drinking stands complete.

PLASTERING WORK.

Provide and render the inside of all outer walls before the same are lathed (basement walls excepted) with one good heavy coat of brown hair mortar. Provide and lay in "pugging" between ground floor and first floor joists for *deafening*, to be composed of coarse mortar and spread in with a mould and so as to be two inches thick in the centre and three inches at the sides, as shown per marginal section. Provide and lath all outer walls (basement walls excepted) and all ceilings and soffits of stairs with best quality of sawn pine lath 1 in. wide for ceilings and 1¼ wide for walls, to be laid on with at least 5-16 of an inch keep joint and breaking joints every sixth lath; lath to be well seasoned and free from sap and other defects. Render, float and set, in best "*three coat*" work, *all* walls and ceilings and soffit of stairs throughout the building (basement excepted), and finish the same in best "hard white finish," all thoroughly trowelled. The basement ceiling throughout is to be plastered in two good coats of plaster, floated and set in hard sand finish, all well trowelled. The mortar for plastering is to be composed of the best quality of lime and clean sharp sand, mixed with an ample quantity of long animal hair, all thoroughly incorporated together. The hard white finish or putty coat is to consist of best plaster of Paris, with a sufficient quantity of *washed white* sand mixed with same. The lathing on outer walls will not be carried below the top of wainscotting, but the plasterer will float on a second coat of brown mortar over the face of the first rough coat, and will carefully point and flush in around frame and all points where necessary. All the foregoing described plastering is to be of the very best and most substantial description and quality, and complete in every respect. The plasterer will provide for and remove all plaster droppings and other plasterers' rubbish and thoroughly clean out the building on completion of the plastering work, doing each room and corridor as the same are completed.

COMPOSITION BLACKBOARDS

All the class rooms, eight of them, will have the best description and quality of composiiton blackboards, made under the directions and supervision of the Inspector of Public Schools of the city of Toronto. These composition blackboards will extend around the four walls of each class room, excepting 15 ft. in length of the platform end of each class room, which will be composed of slate. The width or height of the composition blackboards will be 3 ft. 6 in., excepting the 10 ft. in length at the platform end of each class room, which will be 4 ft. in height. The slate blackboards will be provided and set up by the carpenter, but the plasterer will float the walls at back of same and will finish the composition boards up to and fair and true with the face of the slate. The sum of $150 of the contract amount for plastering will be retained by the School Board until the composition blackboards have been properly tested and approved by the Inspector of Public Schools of the city of Toronto, upon whose certificate of the efficiency of the blackboards the above mentioned sum of $150 will be paid to the contractor.

PAINTING AND GLAZING.

All dressed woodwork is to be well primed, stopped with oil putty and knotted with best spirit knotting preparatory to the regular painting. For particulars of woodwork examine the drawings and read carpenter and joiners specification. All frames and other finished woodwork is to be primed as soon as prepared by the carpenter. All sash are to be primed and glazed as soon as fitted by the carpenter, and carefully stored away until ready for hanging. All dressed woodwork inside and outside of building, including all the woodwork of stairs and entrance steps, also all the woodwork of the privy closets and conveniences in basement, is to be painted in the very best manner and style with the best brand of white lead and linseed oil paint colored to choice tints, to be approved by the architects, and as follows, viz.: The woodwork both inside and outside of building (excepting the inside of the basement) is to have (3) three good coats of paint in addition to the priming coat. The woodwork in basement will be painted (2) two good coats of paint in addition to the priming. All galvanized ironwork, including all gutters, down pipes, hips and vallies, and the deck of roof, is to be painted three good coats of paint, including he *priming* coat, which is to be of red lead. The woodwork of play sheds, iz., the cornice posts and braces to same, also the siding and batten to same, is to be painted two good coats of paint in addition to the priming coat, which is to be the same as described for the school building. The fence along the street frontage of school lot, 200 ft. in length and 4 ft. in height, will consist of open picket fence with gates to same and large corner posts, all dressed stuff. This fence will be primed and painted in (3) three good coats of paint, counting the priming as one coat, and as described for the building. The division fence dividing the play yards will be of dressed stuff, close board, 7 ft. high. This fence will be primed and painted same as described for the picket fence. The two front entrance doors to have four coats of paint and well rubbed down with pumice stone, and finished smooth and clean. Paint the mouldings around the blackboards extending along both sides and two ends of each class room same as described for other woodwork. The entrance door sills, and the treads of entrance steps and of stairs will be of oak, and the floors to ground and first floor stories will be of hardwood. These door sills, treads of steps and stairs and the hardwood floors to the eight class rooms, and the two main corridors and entrance porches, will be twice coated with linseed oil laid on hot, say at a temperature of at least 130 degrees Fahrenheit, and thoroughly well rubbed in with woollen cloths until the same is hard and dry. The stair rails will be well rubbed down and coated with oil as above described, but with three coats of oil. Paint all exposed plumbing pipes and ironwork. Paint the brickwork at back of two false windows two good coats of paint as shall be directed. Provide for and give the walls of basement throughout, including the brickwork of the heating and ventilating apparatus, but excepting the inside of two coal rooms, two good heavy coats of fresh white lime whitewash. The painter will clean off all glass and woodwork, &c., which may have become spotted or stained, &c., during the operation of painting or white-washing.

GLASS AND GLAZING.

The glass used throughout the building is to be of the very best description and quality of *selected* 16 oz. Diamond Star brand of glass, all well cut in, puttied and back puttied, and finished in very best manner complete. The transom lights over all class room doors, and the glass to glass partitions across the upper corridor, also glass in basement entrance doors and to basement borrowed lights, will be glazed as above described. The sash are to be glazed as soon as fitted, and left to harden until ready for hanging. The whole of the painting and glazing is to be executed with the very best of materials and in the most thorough and workmanlike manner, and to the entire satisfaction of the architects in charge of the works. The tenders for painting and glazing of the school building, sheds and fencing are to provide for and include all the painting and glazing as specified, allowing for the work already executed, providing, however, for making good any defects in same so that the whole work shall be a good and workmanlike job and complete in all respects.

BILL OF QUANTITIES.

CARPENTER AND JOINER WORK. $ c.

39857 ft. of pine timber (board measure) in joists, rafters, plates, lintels, etc., and labor in same, as specified - - -

91 squares (100 ft.) of ⅞ in. G & T flooring, 3 in. wide, of white maple, complete - - - - -

4¼ squares of ⅞ in. G & T flooring, of maple, 6 in. x 2 in. beams (these beams are laid on cement floor) to privy closets, complete - - - - - -

67½ squares of 1⅛ in. G & T roof boarding, 6 in. wide to main belfry, front and rear porches, etc., complete - -

91 squares of ⅞ in. rough flooring, 10 in. wide - -

7 squares of ⅞ in. maple raised teacher's platform, on 6 in. x 2 in. bearers, complete - - - - - -

91 squares of 2 in. x 3 in. and 2 in. x 2 in. strapping, basement and ground ceilings, complete - - - - -

76¾ squares of 2 in. x 2½ in. strapping, ground and first floor walls, complete - - - - - -

4 squares of sheeting at basement entrance and upper steps, roof complete - - - - - -

275 running ft. of cornice to main roof, complete - -

58 running ft. of moulding to gablets of main roof, complete -

308 running ft. of chained joists, 14 in. x 2 in., 1⅛ in. packing pieces spiked together and 1 in. iron straining rod, 6 in. x 8 in. x ½ in. end plates, nuts and washers, ¾ in. iron bolts, 72 in number, complete - - - - -

1300 running ft. of ⅞ in. G & T narrow wainscotting mould cap and plinth, 3 ft. 6 in. in height, complete - - -

424 running ft. of ridge rolls and tilting pieces to valleys and eaves, complete - - - - - -

70 running ft. of 1¼ in. iron gas piping, for hand-rail to main stairs, includes bracket and socket flanges to newel, complete

20 running ft. of pine linth, 14 in. x 10 in., dressed, trussed on top and with inch iron rods, nuts, washers, etc., complete -

27 1⅛ in. stair steps, oak tread and 1 rest landing, strings, balustrading, V jointed wainscotting, capping, oak hand-rail, includes the balustrating of well, etc., chamfered posts 6 in. x 6 in., spandrail, 8 in. x 8 in. turned oak newel, etc., complete

15 basement stair steps, oak tread, strings, balustrading, V jointed wainscotting, capping, hand-rail, includes the balustrading of well, etc., chamfered posts, 6 in. x 6 in., spandrail, 8 in. x 8 in. turned oak newels, etc., complete - - - -

17 rear basement steps, 2 x 2 oak plank platform and supports, top, uprights, and diagonal rails, ¾ in. bolts to coping, strings, etc., complete as above - - - -

18 rear entrance steps descending to basement, narrower, 14 in. x 3 in. pine chamfered coping bolted to wall and round oak roll planted on top, complete - - - - -

18 front porch entrance steps, 2 in. x 2 in. slatted treads, 1½ in. oak risers, strings, 2 platforms, oak parapets, and moulded coping, etc., complete - - - - -

2 2⅜ in. front entrance doors, 12 in. x 3 in. frames, lock and other hardware, etc., complete - - - - -

2 2¼ inside porch doors, frames, locks and other hardware, etc., complete - - - - - -

1 2⅜ in. rear entrance door, frame, lock and other hardware, etc., complete - - - - - -

2 2¼ in. basement entrance sash doors, frames, locks and other hardware, etc., complete - - - - -

8 1¾ in. class room doors, frames and fanlight, steel spring latches and other hardware, etc., complete - - -

1 2⅜ in. sliding door, jambs, boxing, hardwood stop, ¾ in. half round sliding rail, wheels, etc., complete - - -

6 1½ in. basement doors, frames, locks and other hardware, etc., complete - - - - - -

4 1⅛ in. foul air chamber and vent shaft doors, frames, hinges and bolts, etc., complete - - - - -

17 1¾ in. basement windows, frames, hinges, pulleys, cords, plumb bob balance, bolts, etc., complete - - -

4 borrowed lights, frames, and with vertical iron bars to corridors in basement, etc., complete - - - - -

1 1¾ in. large half circle window, frame, mullion bars, etc., complete - - - - - -

3 small circular sashes to porch and rear gable, etc., complete

42 1¾ in. English sashes, ground and first floor, boxed frames, double hung, sash lines, weights, lifts, sash fasteners, etc., complete - - - - - -

8 brass pull down hooks and poles, etc., complete - -

2 rear porches to basement entrance steps, includes 6 x 6 in. dressed and chamfered posts, plates, and cross bearers, double sheeting, dressed rafters, facia and crown moulding, etc., complete - - - - - -

48 wrought iron anchors, 36 in. x 2 in. x ½ in., one end turned up 6 in., two ¾ in. bolts other end, etc., complete - -

50 ¾ in. iron bolts, nuts, etc., to bent plates, etc., complete

48 ventilating openings in base of wainscotting, wood frames and wire cloth screens, complete - - - - -

29 privy closets—fit up with risers, seats, hinged covers, 1¼ G & T divisions and screens 36 ft. long, 6 ft 6 in. high capped 3 in. x 3 in. chamfered posts from floor to ceiling, etc., complete - - - - - -

42 small cupboards in class rooms, flock panel doors in two boxes, locks, fasteners, etc., shelving, mould cornice, etc., complete

500 clothes hooks, and screws, etc., complete - - -

1 back board, dressed, to urinal, 6 ft. 3 ins. x 15 in. x 1¼ in., etc., complete - - - - - -

Trimmings to stairs, ventilating stacks, flues, etc., double tusk frames, joists spiked together, 2 in. x ½ in. stirrup pins to stair well, etc., complete - - - - -

Trimming for man-hole, framed door, hinged on top, fasteners and hooks, includes step ladder to same, etc., complete

Bracketting for galvanized iron cornice at belfry, etc., complete

Provide and set all centres for bricklayers, stay frames, case cut stone work as directed, etc., complete - - -

Carpenter to box in plumber's piping, do all cutting, etc., as required, and attend on other trades, etc., complete -

Temporary doors and fasteners and general care of building night and Sundays - - - - - -

Dressing basement window lintels 2 faces and basement door 3 faces, complete - - - - -

Dressing wall face of bond timbers in basement - -

1 blackboard on sliding door panel, 6 sheets of ⅛th in. thick leather 30 in. x 16 in., jointed and glued ready to receive composition - - - - - - -

CHURCH OF THE MESSIAH, AVENUE ROAD,

GORDON & HELLIWELL, ARCHITECTS, TORONTO.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